

## **ABSTRACT**

The methods, apparatus and compositions disclosed herein concern the detection, identification and/or quantification of target cells and/or microorganisms in samples. The assays are based on light emission detected from a bioluminescence regenerative cycle (BRC). Light emission may be related to cell and/or microorganism number through the number of ATP and PPi molecules per cell or microorganism. In certain embodiments of the invention, specific target cells and/or microorganisms may be separated from samples using one or more capture molecules, such as antibodies. The cells and/or microorganisms may be lysed, the contents purified in whole or in part and the ATP and PPi contents determined by BRC. Other embodiments of the invention concern apparatus comprising a series of chambers connected by a monodirectional flow channel, each chamber comprising an affinity matrix with one or more binding moieties attached. In certain embodiments, a multiplex assay may be performed using both antibodies and oligonucleotide probes specific for a pathogen of interest.